

In re Application of: Zeev GLOZMAN et al
Serial No.: 10/647,796
Filed: August 26, 2003
Office Action Mailing Date: November 24, 2008

Examiner: Herng Der DAY
Group Art Unit: 2128
Attorney Docket: 32965

In the Claims:

1. (Currently Amended) A method of image manipulation in an imaging apparatus for preoperative planning and simulating of an orthopedic surgical procedure to be performed on an anatomical structure, using medical images of the anatomical structure, comprising inter alia:

a. providing a real dimension unit defining a length, to appear in an image with said anatomical structure for providing calibration of the imaged anatomical structure;

b. obtaining and displaying the medical images of the anatomical structure along with said real dimension unit prior to said orthopedic surgical procedure, and using said real dimension unit calibration determining an extent of trauma present in said bones;

c. segmenting the anatomical structure into segments in said medical images prior to said orthopedic surgical procedure, said segments being in an original arrangement, the anatomical structure comprising bones and the segmentation comprising segmentation of the bone to form independently movable bone part segments to represent said trauma present in said bones; and

d. using the obtained medical images comprising said calibrated imaged anatomical structure, planning a result of the orthopedic surgical procedure to be performed on the anatomical structure to reduce said trauma present in said bone, by rearranging of said image anatomical structure segments from said original arrangement to simulate said result within said anatomical structure so that calibrated output images comprising said bone segments rearranged to reduce said trauma are produced.

2. (Previously Presented) The method according to claim 1, further comprising dynamic rendering of medical device from pre defined members, the method allowing dynamic rendering of medical devices with a pre defined relationship, wherein two or more members can be integrated to one member in runtime according to a predefined rule.

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3. (Original) The method according to claim 1, wherein said medical images are X-ray images.

4. (Previously Presented) The method according to claim 1, wherein said medical images are a combination of plurality of imaging techniques.

5. (Previously Presented) The method according to claim 1, wherein said medical images comprise a plurality of views of said anatomical structure.

6. (Previously Presented) The method according to claim 1, wherein the obtaining step comprises transforming of said medical images to digital images.

7. (Original) The method according to claim 1, wherein said obtaining includes composing of several images of the same anatomical structure into a full-length view of said anatomical structure.

8. (Previously Presented) The method according to claim 1, wherein the obtaining step comprises calibrating of images.

9. (Previously Presented) The method according to claim 8, wherein said calibrating comprises registration of different views.

10. (Previously Presented) The method according to claim 8, wherein said calibrating comprises dimension and orientation calibration.

11. (Previously Presented) The method according to claim 8, wherein said calibrating comprises image enhancements comprising brightness and contrast adjustments, and edge detection.

12. (Previously Presented) The method according to claim 1, wherein the segmenting step is performed in at least one of a group of ways, comprising: manual performance by a medical expert, automatic performance, wherein the anatomical

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structure segments are segmented according to predefined rules, and semi-automatic performance, wherein the segmenting step is performed automatically with the assistance of a medical expert.

13. (Previously Presented) The method according to claim 1, wherein said rearranging comprises simulating different positioning of said image anatomical structure segments.

14. (Currently Amended) The method according to claim 13, wherein said different positioning of said image anatomical structure segments relates to reducing of said ~~fractures~~ trauma during trauma treatment.

15. (Previously Presented) The method according to claim 13, wherein said different positioning of said image anatomical structure segments relates to pre designed osteotomy treatments.

16. (Previously Presented) The method according to claim 1, further comprising inserting implants, in the manner that superposition of implants and said segmented anatomical structure over non-segmented fragments of said anatomical structure is provided.

17. (Canceled)

18. (Previously Presented) The method according to claim 1, further comprising a step of choosing a plurality of fixation elements from a predefined database.

19. (Previously Presented) The method according to claim 18, further comprising rules for correct positioning of said fixation elements so incorrect positioning of said fixation elements is prevented.

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20. (Previously Presented) The method according to claim 1, wherein said planning comprises producing and storing the output images and planning reports of a plurality of alternatives of said steps of segmenting and planning, for the purpose that the best alternative for medical treatment is selected from said alternatives; said planning report comprising part definition of calibrated artificial elements selected for the treatment as well as patient information.

21. (Original) The method according to claim 20, additionally comprising a step of providing hard copies of said output images and said planning reports of a selected set of said alternatives.

22. (Original) The method according to claim 20, additionally comprising a step of communicating said output images and said planning reports to a plurality of remote users.

23. (Currently Amended) An apparatus for pre planning and simulating of an orthopedic surgical procedure to be performed on an anatomical structure, using medical images of the anatomical structure, the apparatus comprising;

a. a real dimension unit defining a length, to appear in an image with said anatomical structure for providing calibration of the imaged anatomical structure;

b. segmenting means for defining and marking anatomical structure segments in an original arrangement in the medical images of the anatomical structure, the anatomical structure comprising bones and the segments being segments of said bones independently movable to be representative of trauma present in said bones;

c. planning means for planning a result of said orthopedic surgical procedure to be performed on the anatomical structure to minimize said trauma, using the calibrated medical images of the anatomical structure and said real dimension unit calibration to estimate an extent of said trauma, the planning means comprising means for rearranging of said image anatomical structure segments from said original arrangement to simulate said result within said anatomical structure thereby to produce calibrated output images comprising said rearranged bone segments;

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d. a memory for storing said medical images and a desired result; and,
e. a display for displaying said calibrated medical images and said output images.

24. (Previously Presented) The apparatus according to claim 23, further comprising means for dynamic rendering of medical device from pre defined members, allowing dynamic rendering of medical devices with a pre defined relationship, wherein two or more members can be integrated to one member in runtime according to a predefined rule.

25. (Previously Presented) The apparatus according to claim 23, wherein the medical images are X-ray images.

26. (Previously Presented) The apparatus according to claim 23 wherein the medical images are combination of a plurality of imaging techniques.

27. (Previously Presented) The apparatus according to claim 23, wherein the medical images comprise a plurality of views of the same anatomical structures.

28. (Previously Presented) The apparatus according to claim 23, additionally comprising means for transforming said medical images to digital images.

29. (Previously Presented) The apparatus according to claim 23, additionally comprising means for composing of several images of the same anatomical structure into a full-length view of said anatomical structure.

30. (Previously Presented) The apparatus according to claim 23, additionally comprising calibration means for images.

31. (Previously Presented) The apparatus according to claim 30, wherein the calibration means are also utilized for registration of different views.

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32. (Previously Presented) The apparatus according to claim 30, wherein the calibration means are also utilized for dimension and orientation calibration.

33. (Previously Presented) The apparatus according to claim 30, wherein the calibration means are also utilized for image enhancements.

34. (Previously Presented) The apparatus according to claim 30, wherein the calibration means are also utilized for correction of image distortions.

35. (Previously Presented) The apparatus according to claim 23, wherein the segmenting means are manually operated by a medical expert, or wherein the segmenting means are automatically operated according to predefined rules, or wherein the segmenting means are operated semi-automatically in the manner that the segmenting step is performed automatically with the assistance of a medical expert.

36. (Previously Presented) The apparatus according to claim 23, wherein the planning means are additionally utilized for simulating different positioning of said anatomical structure segments.

37. (Previously Presented) The apparatus according to claim 23, wherein the planning means are utilized for simulating reduction of fractures during trauma treatment.

38. (Original) The apparatus according to claim 36, wherein said different positioning of said anatomical structure segments relates to pre designed osteotomy treatments for deformed anatomical structures.

39. (Previously Presented) The apparatus according to claim 23, further comprising implants, for superposition in the manner that superposition of implants and said segmented anatomical structure over non-segmented fragments of said anatomical structure is provided.

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40. (Canceled)

41. (Previously Presented) The apparatus according to claim 23, further comprising a predefined database comprising predefined sets of fixation elements.

42. (Previously Presented) The apparatus according to claim 41, further comprising means for correct positioning of said fixation elements so incorrect positioning of said fixation elements is prevented.

43. (Previously Presented) The apparatus according to claim 23, additionally comprising a means for producing and storing planning reports of plurality of alternatives, for the purpose that the best alternative for medical treatment is selected from said alternatives, said planning reports comprising part definition of calibrated artificial elements selected for the medical treatment and patient information.

44. (Previously Presented) The apparatus according to claim 43, additionally comprising a hard copy producer configured to produce hard copies of said output images and said planning reports of a selected set of said alternatives.

45. (Previously Presented) The apparatus according to claim 43, additionally comprising a communication device for communicating said output images and said planning reports to remote users.

46. (Previously Presented) The method according to claim 1, wherein said real dimension unit comprises an object of a known length.

47. (Previously Presented) The method according to claim 1, wherein said medical images of the anatomical structure are imaged on an imager remote from the location of the orthopedic surgical procedure.

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48. (Previously Presented) The apparatus according to claim 23, wherein said displayed image comprises a final image for the orthopedic surgical procedure.

49. (Previously Presented) The method of claim 1, wherein said obtained output images further comprise, at least one feature selected from the group consisting of: a plurality of calibrated organs; a plurality of calibrated artificial elements; and at least one superposition of said calibrated artificial elements on said calibrated organs or organ segments.